
Aerosol Triggers

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New England Bioterrorism Preparedness Workshop

3-4 April 2002

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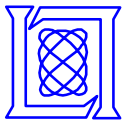
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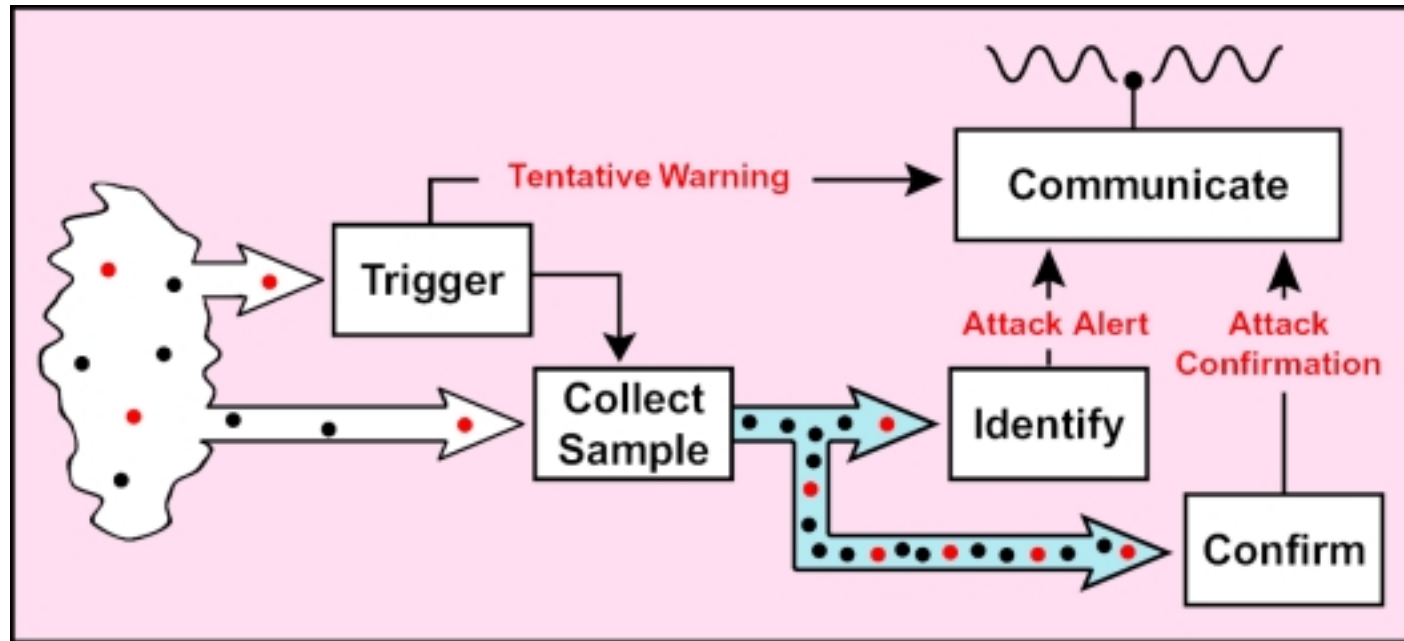
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Biosensor Architecture



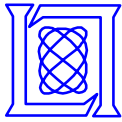
- **Trigger (< 60 s)**
 - Continuous operation
 - Alert of potential threat aerosol
- **Collector (5 min)**
 - Activated by trigger
 - Provide sample of aerosol particles

- **Identification (15 min)**
 - Preliminary identification of agent
- **Confirmation (4 – 24 hr)**
 - Final identification of agent
 - “Gold Standard” tests
 - Performed in laboratory (TAML)



Bio-Aerosol Triggers

- **Raw Particle Counters**
 - Small, low cost
 - Nondiscriminatory - very high false trigger rates
- **Fluorescent Particle Counters**
 - **Ultra Violet Aerodynamic Particle Sizer (UVAPS)**
Trigger for Biological Integrated Detection System (BIDS)
Manufactured by TSI Inc. (St. Paul, MN)
Fluorescence Aerodynamic Particle Sizer (FLAPS)
Different trigger algorithm than UVAPS
Trigger for Canadian Integrated Biological Agent Detection System (CIBADS)
 - **Biological Agent Detection Sensor (BAWS)**
Trigger for Joint Biological Point Detection System
Manufactured by Intellitec (Deland, FL)



Biological Agent Warning Sensor (BAWS)

- **Army Advanced Technology Demonstration**
 - Began BAWS development in 1996
- **Four design generations developed**
- **Extensively tested**
 - Performance
 - Environmental
- **Integrated into the Joint Biological Point Detection System**
 - Development transitioned to JBPDS in 1999.

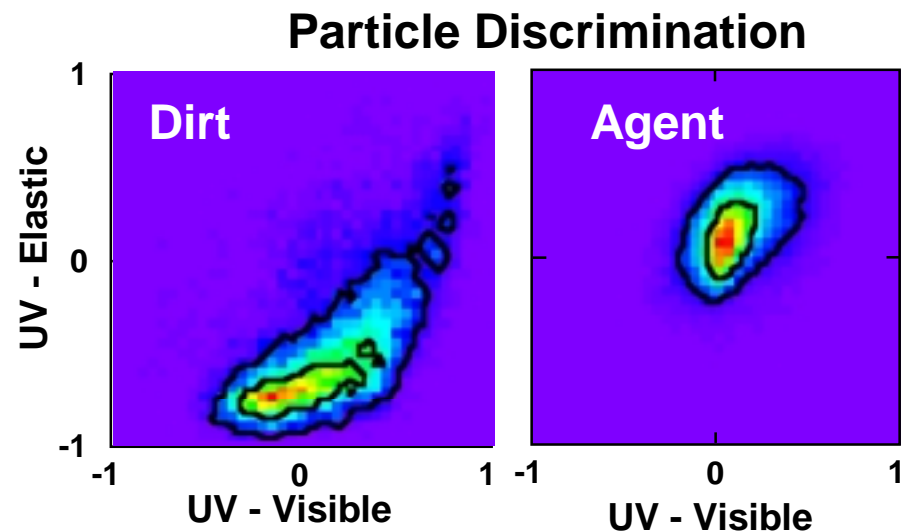
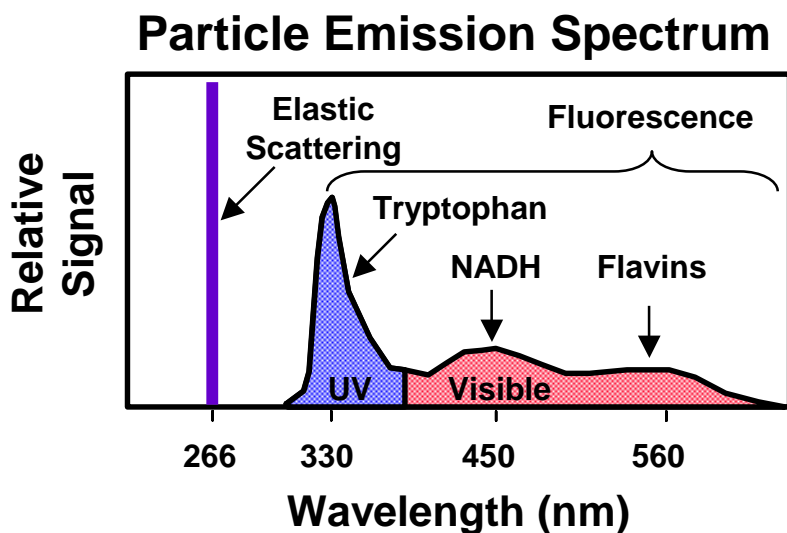
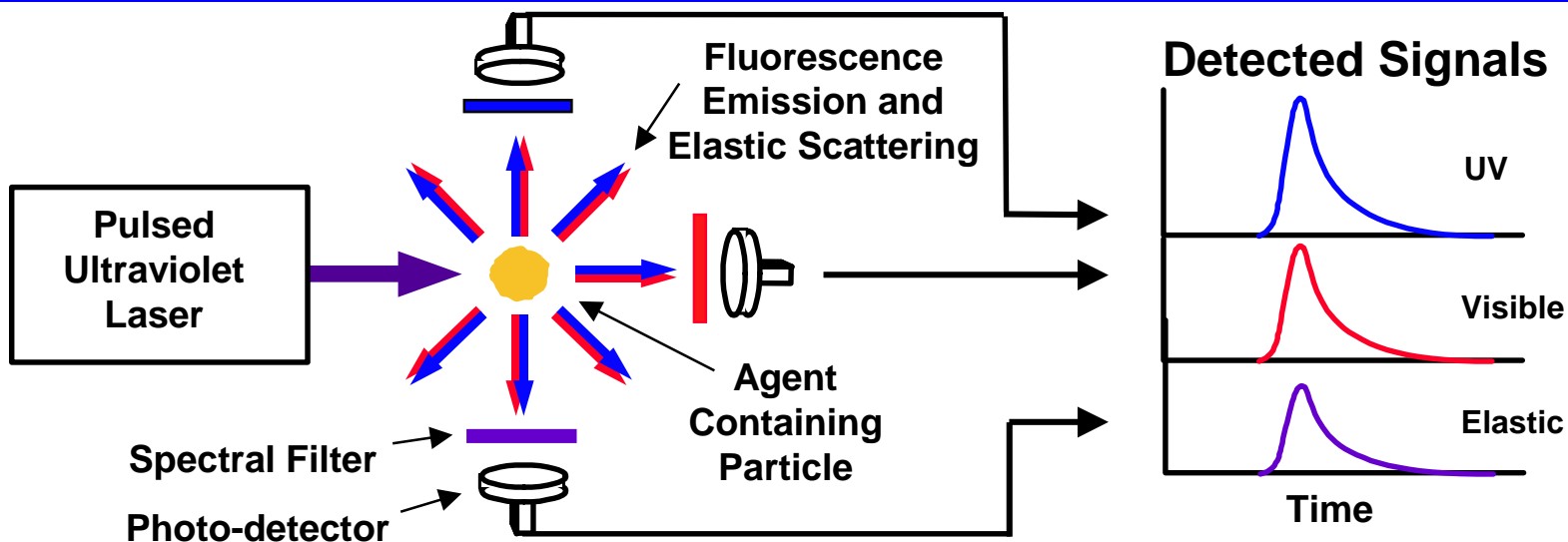
BAWS III

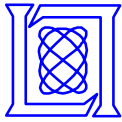


Size	0.8 ft ³
Weight	19 lbs
Power	35 W



BAWS Concept





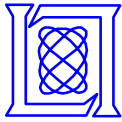
Joint Biological Point Detection System



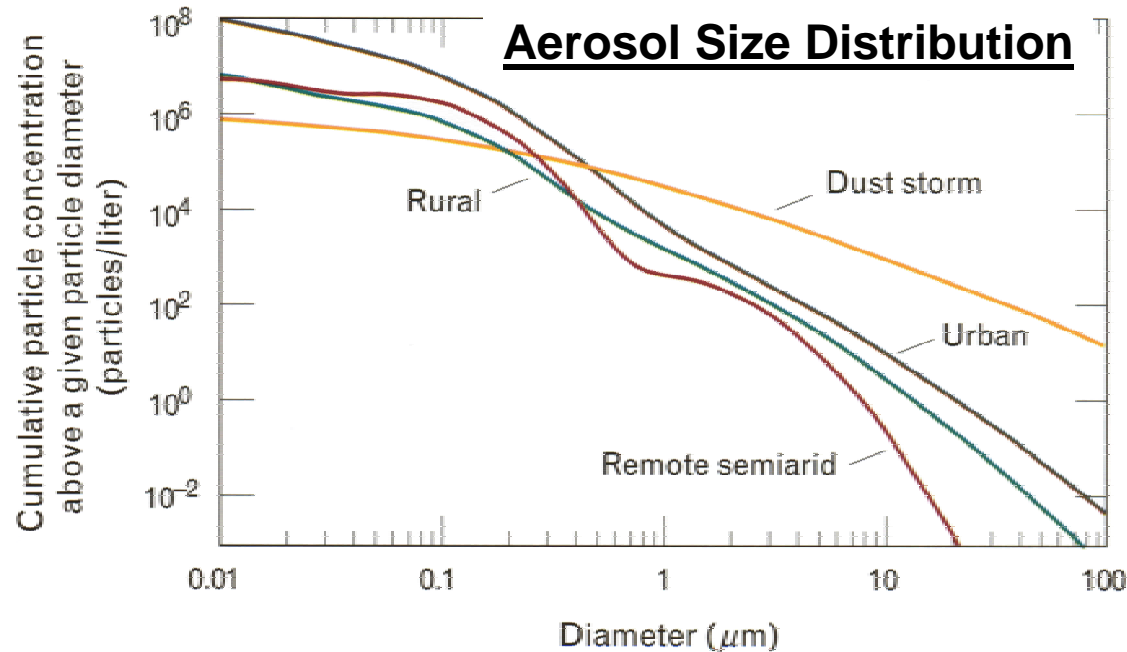
- Automated suite of sensors for detection and identification of biological attacks
 - Trigger – BAWS
 - Collector – Wetted Wall Cyclone
 - Identifier – Immunoassay
 - Confirmatory Samples



BAWS



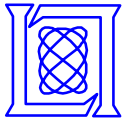
The Atmospheric Aerosol Composition



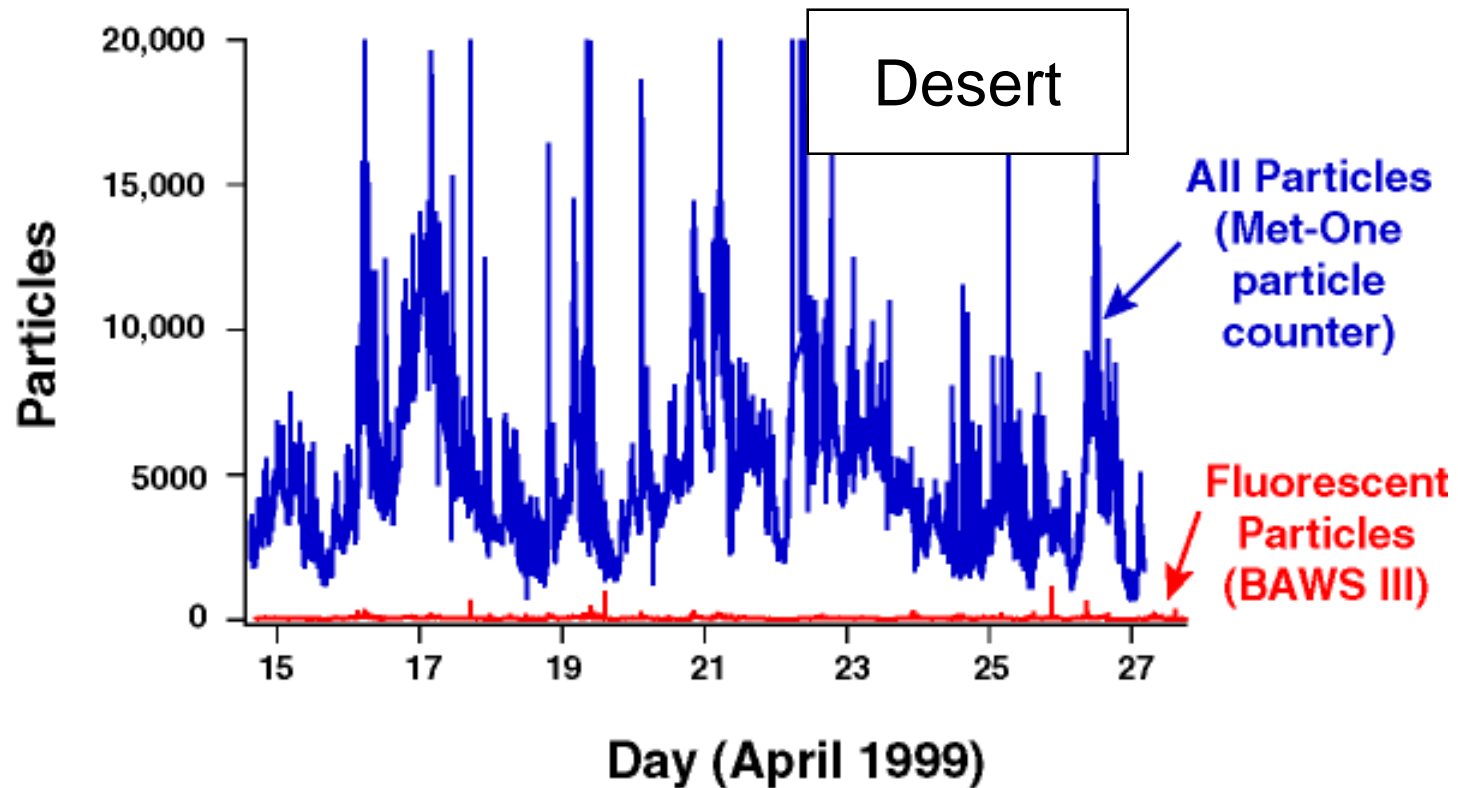
*After R. Jaenicke in Aerosol-Cloud-Climate Interactions, P. Hobbs editor (1993).

Composition of Coarse (>1 micron) Aerosol

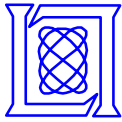
Organic Aerosols	Particles per Liter		Inorganic Aerosols
Man Made	0 – 2000	100 – 10,000	Clays, Sands, Composites
Fungi	0 – 100		
Bacteria (culturable)	0 – 1		
Pollen	0 – 1		



Total vs. Fluorescent Particles



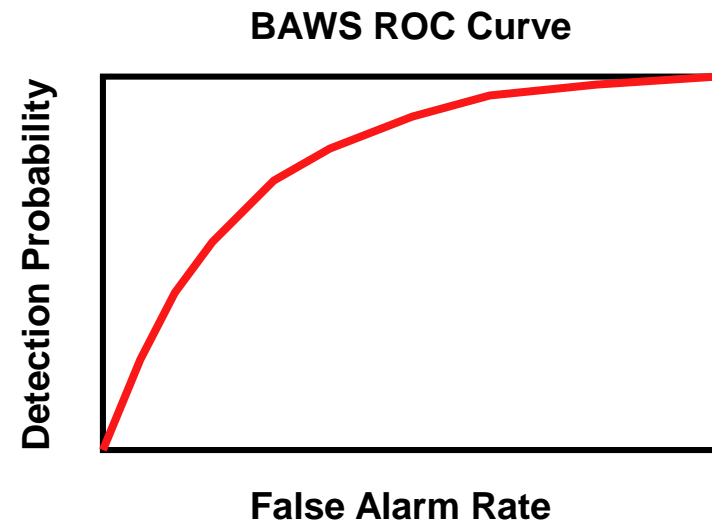
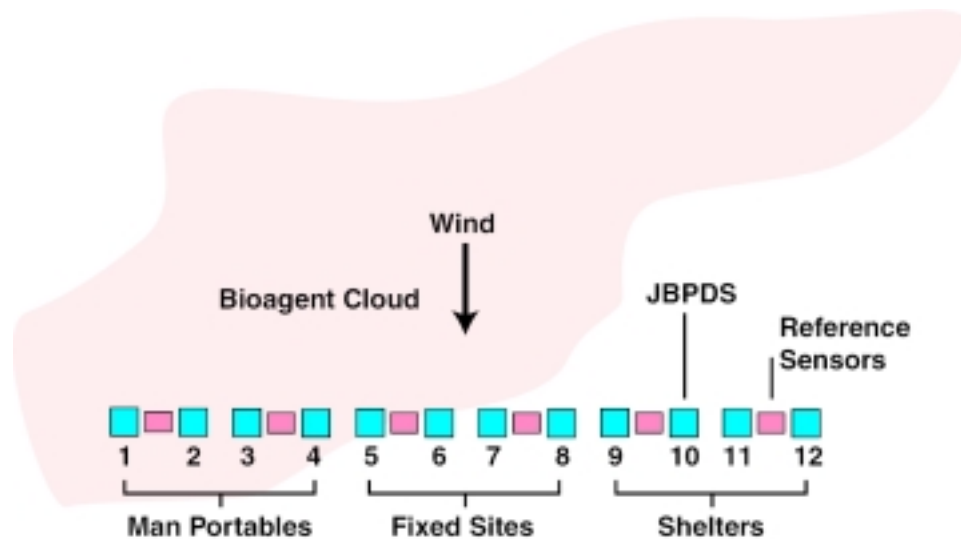
- Most sand particles do not fluoresce and are “invisible” to BAWS



Field Trials

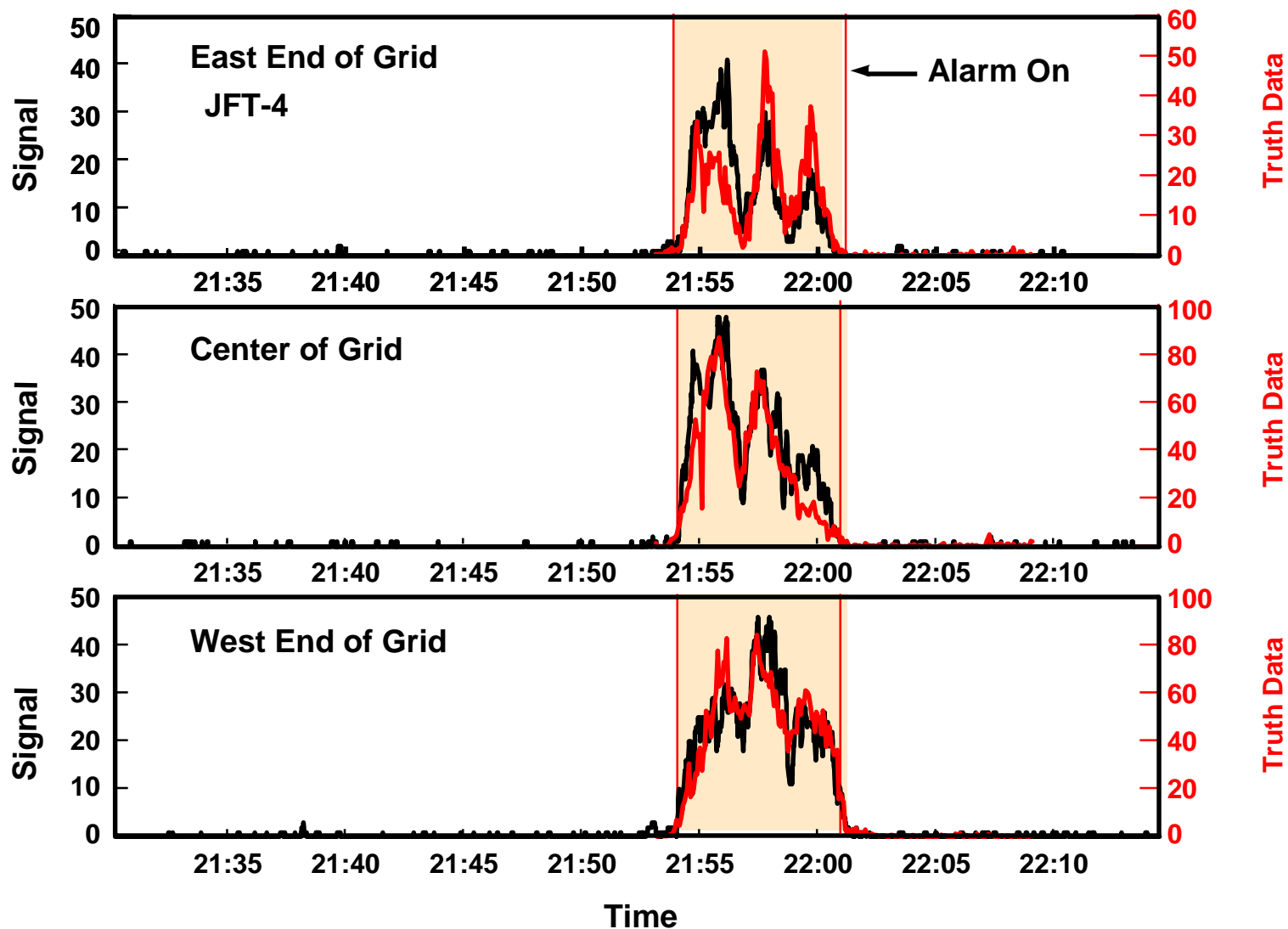


27Oct99 - 9Nov99
BAWS/JBPDS Mini Field Trials





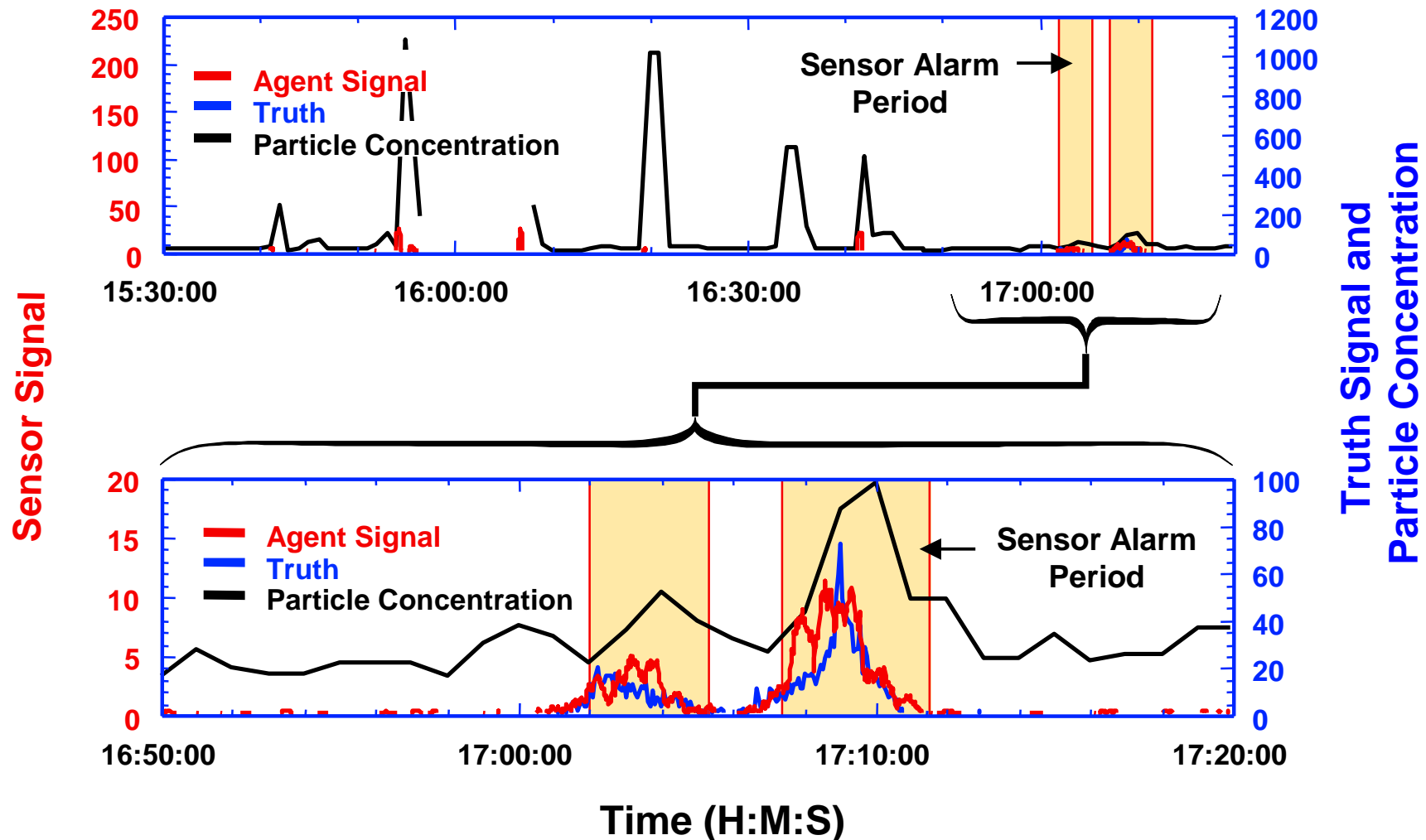
Response of BAWS Array to Agent Aerosol

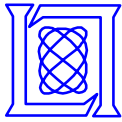




Response of BAWS to Interferent and Agent Aerosol

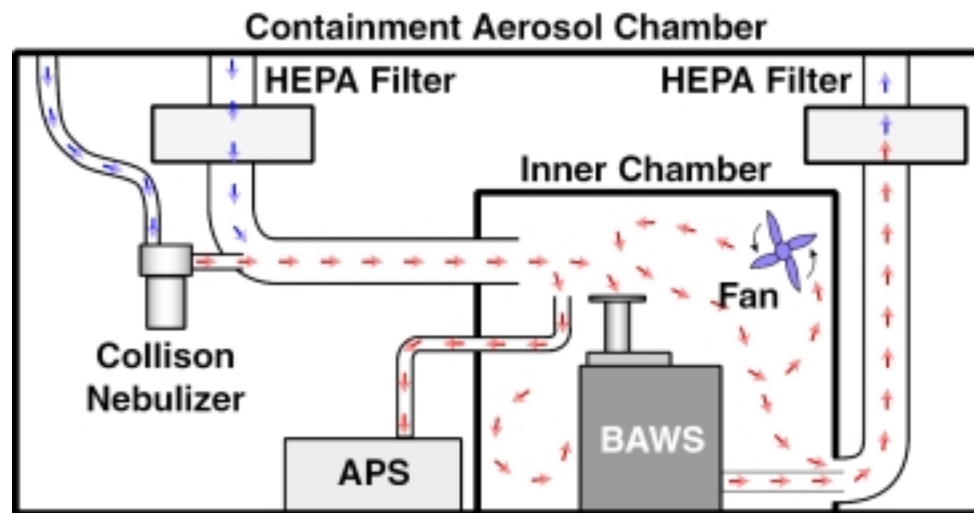
Sensor at East End of Grid



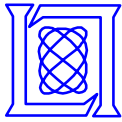


Live Agent Tests of BAWS

- **Comparison of BAWS response to real agents and simulant agents**
 - Simulant Agents; BG, *Erwinia herbicola*, Ovalbumin, MS2
 - Three Real agents



- **Results: BAWS detects live agents as well as, or better than, simulant agents**
 - Equivalent sensitivity
 - Equivalent discrimination

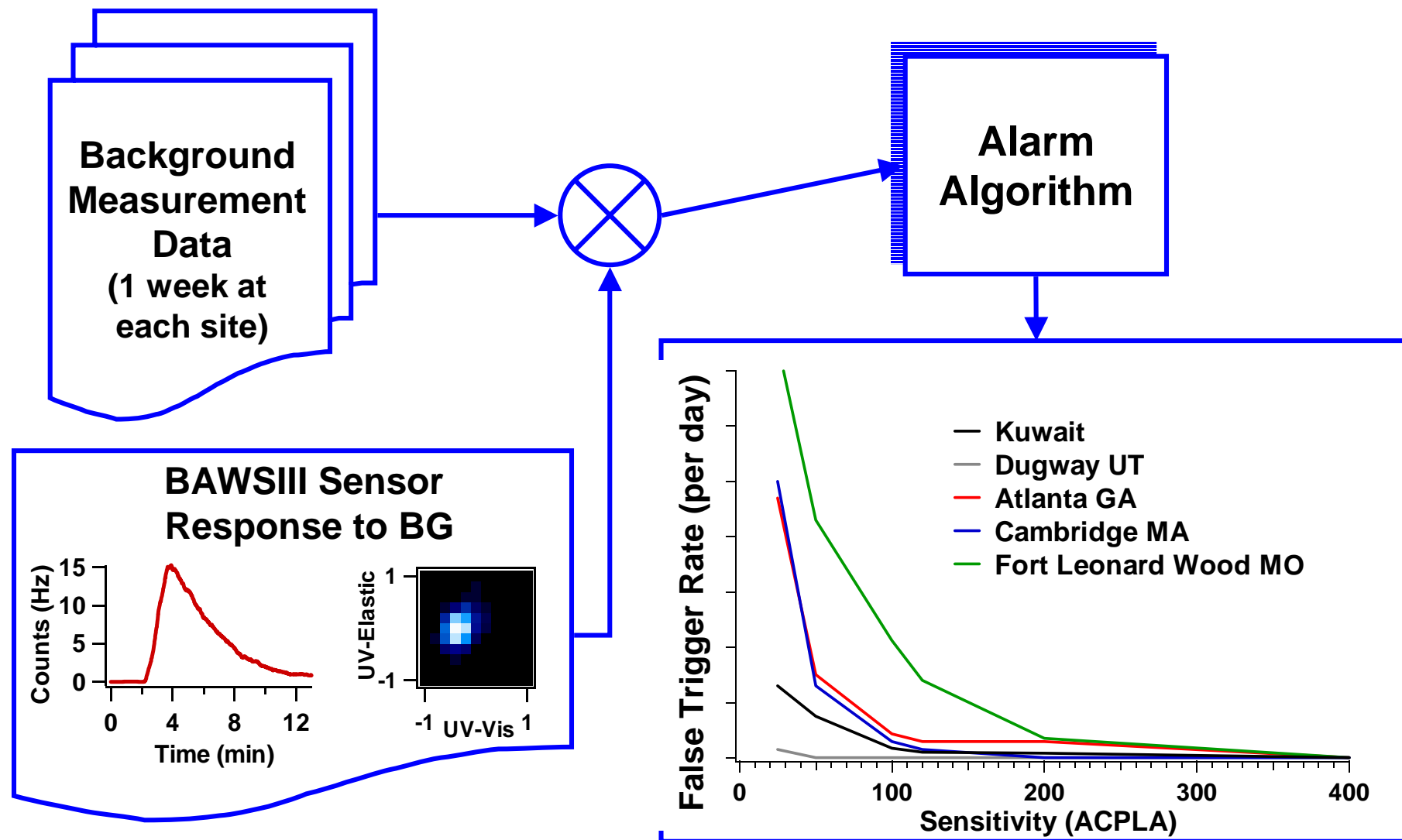


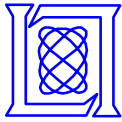
BAWS Performance Testing

- **Joint Field Trials**
 - JFT 3, Dugway Fall '96
 - JFT 4, Dugway Fall '97
 - JFT 4.5, Dugway Spring '98
 - JFT 6, DRES Canada Fall '00
- **Army ATD Field Trials** Spring '99
- **Joint Biological Point Detection System Field Trials**
 - Mini Field Trials Fall '99
 - Gamma-Killed Bio-Agents Spring '99
 - PPQT Spring '00
 - Live Agents Summer '00
 - Porton Down, UK Fall '00
 - Ambient Breeze Tunnel, Battelle Spring '01
 - Operational Assessment 2 Fall '01
- **Background Measurements**
 - USA tour '98 – '99
 - Kuwait Spring '99
 - Altitude study Fall '00
 - Salt Lake City Spring '01
 - Hawaii Summer '01



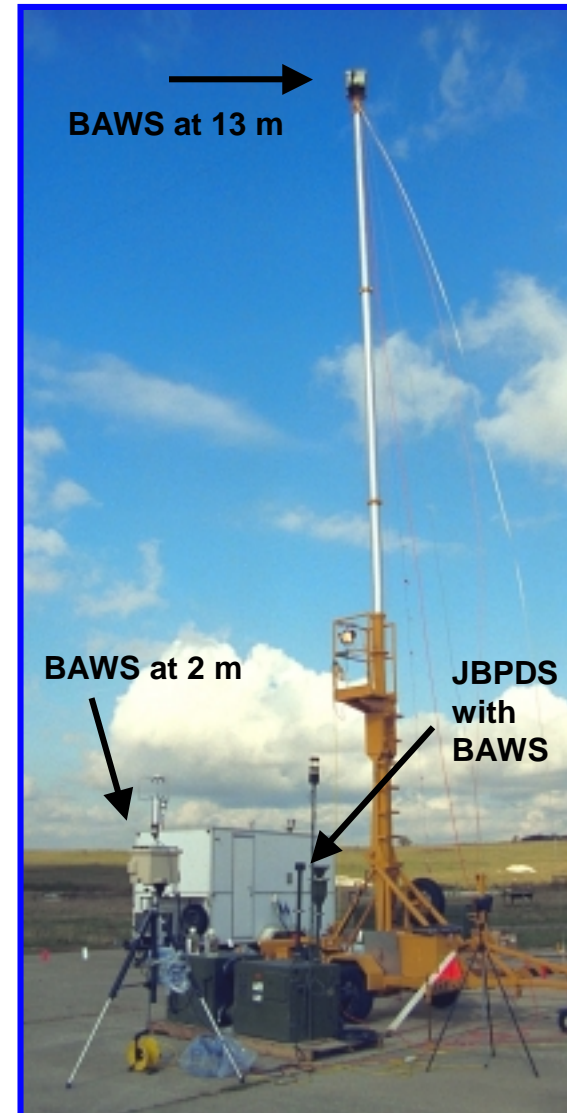
Simulation of BAWS Response to Agent Attacks in Different Environments

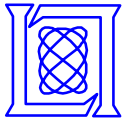




Detector Position vs. False Trigger Rate

- **England (Sep '00)**
 - One week of measurements
 - 21 agent simulant challenges
 - 8 interferent challenges
- **Sensor Performance vs. sensor height**
 - BAWS at 2-m and 13-m height
 - Ten times fewer false triggers at 13-m height





Summary

- **BAWS developed for early warning of a biological agent attack**
 - continuously operating point detector
 - small size, low weight, low power consumption
- **Generic detection (not identification) of threat aerosol**
 - Individual detection of aerosol particles
 - Discrimination of threat particles from non-threat particles
 - Sensitive, low false alarm rate, fast response
- **Subjected to extensive testing**
 - Performance
 - environmental
- **BAWS integrated into JBPDS**